

Wheat

ARS Wheat Rust Resistance Roundup

The stem rust fungus *Puccinia graminis* has long plagued the world's wheat, barley, and other grain crops. But none of the fungus's main types have matched the devastation wrought by Ug99. It's a virulent new race that even stem rust-resistant varieties cannot withstand.

So pressing is the threat posed by Ug99, known scientifically as "*Puccinia graminis* f. sp. *tritici*," that the Agricultural Research Service has committed multiple labs to the global fight against the pathogen. ARS's efforts also support the Borlaug Global Rust Initiative, an international effort to rush newly developed rust-resistant cultivars to affected wheat growers, whether they be in regions where Ug99 already occurs—namely, parts of North Africa and the Middle East—or areas it could spread to next.

The labs, followed by summaries of their Ug99 research, include:

Cereal Disease Laboratory, St. Paul, Minnesota—

Characterizes and monitors Ug99 and other emerging rust strains; tests breeding germplasm of U.S. wheat and barley for resistance to Ug99 in the greenhouse; identifies new sources of resistance in cultivated and wild relatives of wheat; develops molecular markers; and creates genetic maps of Ug99 and other important rust strains. (See "World Wheat Supply Threatened!" *Agricultural Research*, November/December 2007, pp. 4-6.)

Plant Science Research Unit, Raleigh, North Carolina—

Coordinates Ug99 screening of U.S. wheat and barley submissions at the Njoro Research Center of the Kenya Agricultural Research Institute; developed wheat lines with multiple genes for resistance to Ug99 and other stem rusts; and identified resistance sources in several barley lines being tested in Kenya. (See "International Wheat and Barley Screening Collaboration Helps Uncover Stem Rust-Resistant Material," *Agricultural Research*, February 2010, pp. 8-9.)

Small Grains and Potato Germplasm Research Unit, Aberdeen, Idaho—

Coordinates acquisition and shipping of seed from wheat breeders across the United States for testing in Kenya; prescreens landrace wheats from the National Small Grains Collection against local stem rust races; and crosses resistant landraces tested in Kenya to study inheritance in offspring as part of the effort to discover new resistance genes. (See "International Wheat and Barley Screening Collaboration Helps Uncover Stem Rust-Resistant Material," *Agricultural Research*, February 2010, pp. 8-9.)

Cereal Crops Research Unit, Fargo, North Dakota—

Identified novel sources of stem rust and Ug99 resistance in rye, goat grasses, perennial wheat grasses, and other wild species; and combined classical cytogenetics with molecular marker techniques to develop bread and durum wheat lines carrying resistance genes derived from wild relatives of wheat, including *Sr37*, *Sr39*, *Sr43*, and *Sr47*, that are free of "linkage drag"—

unwanted segments of chromosome that can be inherited from wild species along with rust resistance genes, hindering commercial breeding efforts.

Hard Winter Wheat Genetics Research Unit, Manhattan, Kansas—

Identified four new resistance genes from wild relatives of wheat to combat Ug99 and developed genetic stocks for their use in wheat breeding; developed genetic markers and improved germplasm for several Ug99-effective resistance genes, including *Sr22*, *Sr35*, and *Sr40*; used chromosome-engineering techniques to shorten introduced chromosome segments from wild relatives of wheat and thus reduce undesirable linked characters; and use marker-assisted selection to move useful resistance genes into elite hard winter wheat varieties for Central and Southern Plains breeders.—By **Jan Suszkiw**, ARS.

This research is part of Plant Genetic Resources, Genomics, and Genetic Improvement (#301) and Plant Diseases (#303), two ARS national programs described at www.nps.ars.usda.gov.

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Ug99-infected wheat from a nursery in Njoro, Kenya.